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Research article

Understanding scuba divers' response to coral bleaching: An application of Protection Motivation Theory

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ABSTRACT

Coral reefs are important to the dive experience, suggesting the expected increase in coral bleaching events has the potential to alter global flows of dive tourists. There are a growing number of studies that suggest taking people's estimation of their options and ability to react to a threat into account provides a clearer picture of the decision to respond to a threat. This study applied Protection Motivation Theory (PMT) to help understand the motivational factors associated with intended adaptation to coral bleaching. Multiple regression analysis was used to analyze the effects of threat and coping appraisal variables. This study provided the first empirical evidence of scuba divers' response to marginal reef conditions, indicating that the majority of respondents would significantly alter their behavior in some way. PMT was able to explain between 12.8% and 47.7% of the variance in adaptation intentions, with response efficacy and self-efficacy consistently emerging as the strongest significant predictors. Consideration of multiple adaptation responses demonstrates the variability of model performance and highlights the need to consider the context of adaptation when interpreting results. Implications for future research and the dive tourism industry are discussed.

1. Introduction

The opportunity to look at corals and marine life is consistently cited as one of the main reasons for diving (Ditton et al., 2002; Garrod, 2008; Meyer et al., 2002; Shani et al., 2012; Thailing and Ditton, 2003; Todd et al., 2002), and a main contributor to diver satisfaction (Davis and Tisdell, 1996; Dearden et al., 2006; Fitzsimmons, 2007; Loomis et al., 2008; MacCarthy, O'Neill and Williams, 2006; Musa, 2002; Musa et al., 2006; Paterson et al., 2012; Tabata, 1992), suggesting that healthy coral reef environments are important to the dive experience. But these marine ecosystems are also considered to be one of the most vulnerable to climate change (Hughes et al., 2003). Globally, ocean warming appears to be the primary climate-related driver affecting reef health (Burke et al., 2011; Selig et al., 2010; Wong et al., 2014). Abnormally high ocean temperatures in recent years has led to bleaching events that are more frequent, intense, and widespread (Eakin et al., 2009; Hoegh-Guldberg, 1999), and it is expected that coral bleaching and mortality will continue to increase in frequency and magnitude, with estimates that 99 percent of all reef locations will experience at least one severe bleaching event by the last decade of the twenty-first century (under the A1B emission scenario) (Wong et al., 2014).

While bleaching is expected to occur globally, regional variations in weather patterns, sea levels, and reef structure/conditions may result in some areas being harder hit than others (Donner et al., 2005). Thus, some of the world's top dive destinations may be disproportionately impacted by coral bleaching in the future, which has the potential to alter global flows of dive tourists. Since tourism and recreation implicitly involve activities undertaken by choice during leisure time, it follows that individuals have a great deal of flexibility in choosing the time, space and type of activities they wish engage in (Scott et al., 2009), and thus have considerable capacity to adapt to risks or opportunities presented by environmental changes (Scott et al., 2008). Therefore, it is important for tourism and recreation researchers to develop a better understanding of adaptation behavior in response to adverse recreation conditions.

This study responds to the need for further research on behavioral adaptation as it relates to scuba divers. In particular, the study aims to understand the cognitive processes that determine whether or not scuba divers adapt their behavior in response to a coral bleaching event by applying a cognitive framework. These findings provide insights to dive tourism destinations, particularly those identified as highly vulnerable due to ongoing bleaching events.

2. Background

There is disagreement about how coral bleaching might affect

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tourists' dive-related behavior. Some argue that such climate-induced environmental change has given rise to a new tourism phenomenon, referred to as 'disappearing destinations', 'last chance tourism', or 'climate disaster tourism', in which a destination or attraction is sought out before it is 'lost' to climate change (Lemelin et al., 2013; Lemelin et al., 2010). However, most destinations and tour operators appear to strongly resist attempts to associate with climate change or last chance tourism marketing, considering it to be a short sighted view, and there has been little research to support such a trend (Scott et al., 2012). Many dive operators simply do not believe that climate change will have any effect on their operations (Gossling et al., 2008; Marshall et al., 2011; Sealey-Baker, 2011). Gossling et al. (2008), for example, found that most dive operators did not think global environmental change had had any consequences on dive tourism, going so far as to state: "as long as the water is clear, people will continue to dive" (p. 83). A third possibility is that divers will adapt their behavior in some way, so as to avoid or minimize their exposure to changes to the marine environment. After the 1998 mass bleaching event, Cesar (2000) reported that the percentage of dive tourists visiting El Nido in the Philippines decreased, with resorts that used to cater to the exclusive high-end of the dive market faring most poorly. A similar study off the coast of East Africa found that over 80 percent of those who were aware of the bleaching in the area indicated that knowledge that an area was bleached would affect their decision to visit and/or dive in that area (Westmacott et al., 2000).

2.1. Tourists' behavioral adaptation

To date, research into tourists' behavioral adaptation and climate change has largely focused on ski and winter tourism, emphasizing the relationship between warming temperatures and declining snow cover. The results from these studies suggest that the majority of skiers would significantly alter their behavior in some way (Behringer et al., 2000; Dawson et al., 2009; König, 1998; Pickering et al., 2010; Rutty et al., 2015; Steiger, 2011; Vivian, 2011). In each of these studies, skiers were proportionately more likely to engage in spatial substitution (38–68%) compared to temporal (11–36%) or activity substitution (0–25%). What is not clear, and represents a gap in knowledge, is an explanation of why one form of substitution might be preferred over another, where it occurs at all.

2.2. A cognitive approach to adaptation

In the broader literature, research on climate change adaptation and adaptive capacity has emphasized the role of objective assets or determinants, such as financial capital (Grothmann and Patt, 2005; Yohe and Tol, 2002). Objective capacity highlights what could be done, given access to available resources. But the objective ability or capacity of a human actor only partly determines if an adaptive response is taken. There are a growing number of studies examining the link between cognitive factors and adaptation (Grothmann and Patt, 2005; Marshall and Marshall, 2007; Marshall et al., 2013; Viscusi and Chesson, 1999; Weber, 1997), which suggest that by taking people's estimation of their options and ability to react to a threat into account, along with the effectiveness and costs of these options, one can gain a much clearer picture of the decision to respond to a threat.

The more resources and opportunities perceived to be available to an individual, and the fewer anticipated obstacles or impediments, the greater one's perceived control over the behavior. Higher levels of perceived behavioral control are typically associated with more favorable intentions to perform behaviors. Hagger et al. (2002) meta-analysis of 72 health studies employing the Theory of Planned Behavior (TPB) demonstrated that perceived behavioral control was one of the most consistent and reliable predictors of physical activity-related intentions and behaviors. Similarly, Yuzhanin and Fisher's (2016) meta-analysis of 15 tourism studies that use TPB to predict intentions to choose a tourist destination found that the majority of the reviewed studies concluded that perceived behavioral control was the most influential factor in predicting intentions of travelling to a particular destination. However, controllability alone does not directly speak to the utility of coping strategies at responding to a particular stress experience. Schuster et al. (2006) suggested that future stress-coping research should consider the efficacy of coping mechanisms, but this suggestion has not, as of yet, been applied.

Risk perceptions can become overriding factors when introduced into travel decisions, changing the context of conventional models of decision-making. There is general agreement that tourists tend to avoid destinations with greater perceived risks (Batra, 2008; Chen and Noriega, 2004; Floyd et al., 2004; Kingsbury and Brunn, 2004; Law, 2006; Sönmez and Graefe, 1998a, 1998b). Following the 9/11 terrorist attacks, most tourism risk studies focus on risks posed by terrorism, political instability, and crime. However, earlier risk studies acknowledged a much broader subset of risks to a person while undertaking tourist activities (e.g., Jacoby and Kaplan, 1972; Solomon, 1999; Sönmez and Graefe, 1998b), including risk to satisfaction (i.e., possibility that trip will not provide personal satisfaction) (Roehl and Fesenmaier, 1992). Tourist satisfaction is widely acknowledged as a factor that influences future behavioral intention (Fornell et al., 1996; Hellier et al., 2003; Um et al., 2006). Yet, the extent to which satisfaction is considered as an influence on future intentions is often limited to revisit intentions and communications. There is little consideration given to changes at a destination that could pose a risk to one's personal satisfaction with a trip. This idea is core to past tourism and climate change adaptation studies, but potential behavioral changes have not been framed in terms of risk. The advantage of doing so is that it brings the reason for behavioral adaptation to the fore. This requires that the decision-making model used to explain or predict behavior must explicitly consider risk perceptions.

2.3. Protection Motivation Theory

Protection Motivation Theory (PMT) (Rogers, 1983) provides a useful framework to evaluate scuba divers' threat and coping appraisal processes. PMT was originally developed as a framework for understanding the persuasive impact of fear appeals, focusing on the conditions under which fear appeals influence behavior (Rogers, 1975). Following Leventhal's (1970) parallel response model, perceptions of severity, vulnerability, rewards of maladaptive responses, self-efficacy, response efficacy, and response costs were organized into two independent cognitive mediating processes, focusing on threat appraisal and coping appraisal (Fig. 1).

The threat appraisal process focuses on the source of a threat and factors that affect the probability of a maladaptive response, such as denial. The extent to which a potential threat poses harm (perceived severity) and the likelihood of experiencing a given threat (perceived vulnerability) inhibit maladaptive responses. While perceptions of severity and vulnerability inhibit maladaptive responses, intrinsic (e.g. pleasure) or extrinsic (e.g. social approval) rewards may increase the likelihood of maladaptive responses. However, this component is rarely assessed because any reward associated with not performing protective behavior can be rephrased as a response cost of engaging in protective behavior (Abraham et al., 1994).

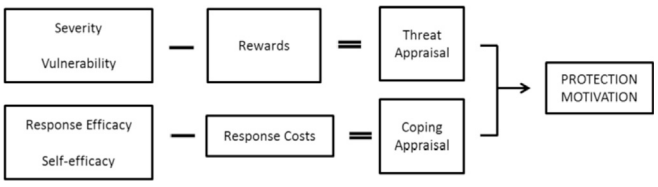

Fig. 1. Protection motivation theory (Rogers, 1983).

Coping appraisal focuses on coping responses to deal with the threat and factors that affect the probability of a protective or adaptive response. Both the belief that the adaptive response is able to prevent or minimize a given threat (perceived response efficacy) and the belief that one is able to perform this response (perceived self-efficacy) increase the probability of adaptive behavior, while perceived response costs or barriers may inhibit an adaptive response.

Protection motivation (i.e., intention to perform a recommended behavior) results from these two appraisal processes. It is a positive function of perceptions of severity, vulnerability, response efficacy, and self-efficacy, and a negative function of perceived response costs of the adaptive behavior. For protection motivation to be elicited, perceptions of severity and vulnerability should outweigh the rewards associated with maladaptive responses, and perceptions of response efficacy and self-efficacy should outweigh the response costs of the adaptive behavior. Protection motivation is typically equated with behavioral intentions, operating as a mediating variable between the threat and coping appraisal processes and protective behavior.

2.4. Applying Protection Motivation Theory to climate change adaptation

Grothmann and Patt (2005) were the first to apply PMT to a climate change adaptation context, developing the Model Private Proactive Adaptation to Climate Change (MPPACC). In their model, protection motivation and coping appraisal are relabelled as adaptation intention and perceived adaptive capacity respectively, becoming one of the first studies to acknowledge the importance of individual's subjective adaptive capacity in determining adaptive responses. Examining flood preparedness in Cologne, Germany, the authors find that socio-cognitive factors proved to be better predictors of household-level adaptation than socio-economic variables, explaining between 26% and 45% of the variance in all four adaptive responses.

Subsequent applications of PMT to predict agricultural adaptation behavior (Dang et al., 2014; Truelove et al., 2015; van Duinen et al., 2015), adaptation to water stress (Kuruppu and Liverman, 2011; Tapsuwan and Rongrongmuang, 2015), and flooding associated with sea-level rise (Koerth et al., 2013), suggest that the framework has relatively high explanatory power, explaining between 23% and 49% of variation in climate change adaptation intentions. Self-efficacy and response efficacy are most frequently identified as being the strongest predictors of adaption intention, further highlighting the importance of incorporating a measure of subjective adaptive capacity when determining individuals' adaptive responses.

Most of the applications of PMT within the climate change adaptation literature have focused on situations in which one's home or livelihood is threatened. Tourism and recreation, in contrast, differ from many other sectors affected by climate change because participation is generally a discrete, voluntary act that is often a luxury activity. This could have implications for the degree to which risk and coping appraisal influence one's intention to adapt. Tourists' and recreationists' appraisal of a risk to leisure environments, for example, is likely to differ dramatically from that of farmers concerned about flooding. Having an understanding of the influence and significance of risk and coping appraisal items in a leisure context is important because it provides insight into factors supporting or hindering individual engagement in adaptation, and also speaks to the voracity of PMT as a theoretical framework for understanding climate change adaptation intentions.

There are only three known applications of PMT within the field of tourism and climate change. Tapsuwan and Rongrongmuang (2015) identify how well stakeholders in the dive tourism industry of Thailand can adapt to climate change threats. However, the small sample (nine semi-structured in-depth interviews) is limited to supply-side stakeholders, and there is no mention of coping appraisal items in the results or discussion, which limits the utility of this application. Nevertheless, the authors suggest that an analysis of the demand side of the tourism industry would be a worthwhile pursuit for insights on how climate change will affect tourists' behavior and preferences.

Horng et al. (2014) apply PMT to evaluate tourists' Energy Saving and Carbon Reduction behaviours, emphasizing tourism as a threat to the environment (i.e., mitigating behaviour), rather than climate change as a threat to tourism (i.e., adaptation behaviour). Conceptually, climate change adaptation measures have more in common with health-related behaviours than do climate change mitigating behaviours (Hunter and Röös, 2016). Unlike mitigating behaviours, which deal with actions to reduce greenhouse gas emissions to avoid further increased climate change, and thus must consider the latent conflict between collective benefits and individual costs, both adaptation and health behaviours seek to reduce direct personal risk.

The study by Wang et al. (2018) is the only known application of PMT to individual tourists' adaptation behaviour. However, there are several significant conceptual and methodological issues that affect the validity and reliability of the study's results. Conceptually, the authors seek to integrate PMT with Bryant et al.'s (2000) individual's (farmer's) climate change adaptation process model to allow "simultaneous consideration of the potential transformations induced by climate change in light of the qualities of tourism systems and possible cognitive mediating factors that these changes may generate from tourists" (Wang et al., 2018, p. 5). In practice, this involves separately assessing tourists' climate change perception, shift in destination attractiveness (as a result of climate change), and threat appraisal as it relates to relates to effect of climate change on destination attractiveness (e.g., I feel that the effects of climate change will severely alter the destination attractiveness of Kenting). A more direct way to capture shifts in destination attractiveness, understood here as the perceived ability of a destination to satisfy one's holiday needs, is to frame threat appraisal in terms of satisfaction risk, as discussed in section 2.2.1.

In the cause of coping appraisal, the authors evaluate the effects of green tourism behaviours on destination attractiveness. This is problematic because the coping behaviours specified do not match the adaptation intentions evaluated. For example, the survey asks respondents whether "green tourism behaviours will reduce the changes in the destination attractiveness of Kenting" (Wang et al.,2018 p. 16), as a measure of response efficacy. However, adaptation intentions focus on specific behavioural (e.g., I left Kenting sooner than planned), physical (e.g., find shaded areas in Kenting to engage in tourism activities), and psychological (e.g., media reports have made me think of the impacts of changes to the attractiveness of Kenting) adaptations. Furthermore, the construct of self-efficacy focuses on belief of effectiveness rather than ability to perform (e.g., my green tourism behaviours in Kenting will reduce the changes in the destination attractiveness), resulting in a redundancy with response efficacy. Nor do the authors evaluate response costs.

Perhaps most concerning is the preconditions set to determine the included survey responses. The authors limit the sample to participants who: (i) perceive climate change; (ii) believe they would not travel to Kenting if its destination attractiveness were altered by climate change; and (iii) would adjust their tourism behaviours in response to these hypothetical shifts in destination attractiveness, thus removing 223 of the 556 questionnaires submitted. The rationale offered is that other respondents were excluded because adaptation is not possible in these participants. Yet, this very removal has eliminated the possibility of evaluating the merit of this assumption, effectively biasing the sample to comply with the proposed framework. For example, the fourth hypothesis proposes that "a threat appraisal has a significant positive relation with a coping appraisal" (Wang et al., 2018, p. 9). Yet, those participants for who this relationship may not have held true are not a part of the study sample. It is perhaps unsurprising that the authors find support for all six of their hypotheses and a high explanatory power (R^2 = 0.58).

In light of this critique, the goal of applying PMT to the study of tourists' adaptation behaviour is to develop a better understanding of

what motivates a person to perform a given behaviour when encountering adverse recreation conditions. Specifically, coral bleaching has been identified as a potential threat to diver satisfaction. Previous applications of PMT in tourism research suggest that the nature of the perceived threat can have implications for the utility of the model. For example, Horng et al. (2014) found that threat appraisal was not as effective a predictor as expected. The authors suggest that this may be because tourists do not generally believe that tourism poses a serious threat to the environment, contrasting the immediacy and urgency of a health risk, for which the framework was originally designed, with that of the risks posed by climate change. Similarly, Tapsuwan and Rongrongmuang (2015) suggest that the limited evidence of active climate change mitigation and adaptation is partly a result of respondents' perceiving climate change as a long term, global problem beyond their control. Moreover, this could have implications for the predictive ability of coping appraisal, such that "a minimum level of threat or concern must exist before people start contemplating the benefits of possible actions and ruminate their competence to actually perform them" (Schwarzer, 1992, p. 235).

2.5. Study hypotheses

It is expected that the constructs that comprise PMT will combine to explain significant proportions of the variance in the adaptation intentions under investigation, specifically:

H1. As perceived vulnerability increases, intention to adapt increases

H2. As perceived severity increases, intention to adapt increases

H3. As perceived effectiveness of an adaptation response increases, intention to adapt increases

H4. As perceived ability to carry out adaptation increases, intention to adapt increases

H5. As perceived cost increases, intention to adapt decreases

3. Methodology

The study adopts a cross-sectional survey research design, aiming to collect data from scuba divers ex situ. Quantitative data was collected to approximate measures of PMT to evaluate the predictability of adaptation intentions via threat and coping appraisal factors.

An online questionnaire was used to collect data between May and August 2016, which allows for the possibility of capturing tourists or recreationists who have already been displaced. White et al. (2008) and Budruk et al. (2008) suggested that visitor displacement likely had a significant impact on insignificant or inconclusive findings in their research. Manning and Valliere (2001) offer a similar explanation for why empirical research often finds that visitor satisfaction may remain relatively high despite crowded conditions, where visitors who are more sensitive to increased use levels or replaced (i.e., displaced) by those who are less sensitive. Participants in this study consisted of scuba divers that belong to a scuba diving club in Canada or Australia. Dive clubs were deemed the most appropriate option for inviting a large number of divers to participate because it is difficult to connect with individual divers away from dive sites.

A total of 387 questionnaires were submitted. Of this, 9 respondents did not meet the screening criteria. Respondents who stopped the survey part way through were excluded from the sample, removing an additional 75 potential respondents, while those who completed the full survey or answered all questions in part were retained. Missing value analysis was used to fill in any missing data points, an approach suitable when data points are missing at random (Schafer and Olsen, 1998). Thus, 303 questionnaires were retained for subsequent analysis, of which 194 completed questionnaires were from Canadian respondents and 109 from Australian respondents.

The questionnaire was designed to assess PMT constructs in relation to six adaptation responses that could be used to minimize one's dissatisfaction with dive conditions. Adapted from Dawson (2009), five of the responses represent different displacement behaviors (i.e., spatial, temporal, and activity). The decision was made to exclude options related to change in timing, (e.g., waiting for better conditions or stopping for part of the season), since waiting for recovery is an unlikely option in the short term given the extended duration of coral bleaching (Baker et al., 2008). Instead, temporal displacement is assessed with one item that measures change in intensity (i.e., dive less often). Activity displacement is similarly assessed with one item that looks at doing some other recreational activity instead of diving. Spatial displacement is assessed via three items that consider intra-site, intra-regional, and inter-regional displacement. Because van Duinen et al. (2015) found that various components of the threat and coping appraisal processes influenced adoption decisions differently across three scales of drought adaptation measures, these three scales of spatial displacement were analyzed separately. Finally, Dawson's "do nothing" option (i.e., dive as often and in the same place as usual) was modified, since it could either result from adaptation being deemed unnecessary or cognitive adaptation. Drawing from Lazarus and Folkman's (1984) model of stress and coping appraisal, respondents instead were asked to reflect on the statement, "There is nothing I can do about it, so I'll just enjoy the experience for what it is", which represents a form of psychological distancing. This was deemed adequate as Johnson and Dawson (2004) recommend that cognitive coping strategies be evaluated as one measure.

Respondents were asked to rate (on a five-point scale): (i) the effectiveness of each of the six adaptation responses at producing a satisfactory experience should coral reefs that are mostly white be encountered (i.e., response efficacy); (ii) their perceived confidence in carrying out each of the six adaptation behaviors "if the need arose" (i.e., self-efficacy – this phrasing allows self-efficacy to be evaluated in isolation of resource conditions, and thus examine the independent influence of this factor on behavioral intentions); (iii) the cost of the six adaptation responses (i.e., response costs); and (iv) the likelihood of performing the six coping mechanisms were coral conditions to persist in the self-specified location (i.e., adaptation intentions).

Perceived severity was measured with two items. Respondents were asked to rate the how much satisfaction with (i) their dive, and (ii) their overall trip, would increase/decrease if coral bleaching were encountered. Because multiple adaptation responses involve potentially changing where one travels to, it was deemed necessary to situate recreation activity choices within a broader decision-making framework. Perceived vulnerability was measured with two items that looked at perceived likelihood of encountering reefs that are mostly white while (i) diving at a self-specified dive location or (ii) while diving elsewhere. This was to assess if one's preferred dive place is seen as more or less vulnerable than other locations.

4. Results

4.1. Respondents

The characteristics of the total sample were typical of the scuba diving population (Table 1): predominantly male (65%), older (M = 46.1, SD = 13.9), well-educated (63% with an undergraduate or advanced degree), and middle-to-upper middle class (60.1% with a household income greater than $100,000). Overall, the most common level of certification was Advanced Open Water (43.2%), while another 39.6% of respondents had either a Dive Master or Dive Instructor certification, suggesting that the respondents in this study represent a fairly advanced level of diver and may not be representative of novice or beginner divers. Friends were the most frequent dive companions (38.9%), followed by one's partner/spouse (32%), and acquaintances, i.e., individuals met at the dive site (20.5%). A small proportion of

Table 1
Sample demographic and diver characteristics.

Gender (male)	65%
Age	46.13 (13.88)
Education	
High School	9.6%
Certificate/trade	7.9%
College diploma	19.5%
University degree	26.4%
Graduate degree	36.6%
Household income	
< $50,000	10.2%
$50,000-$99,999	14.5%
$100,000-$149,999	27.4%
$150,000-$199,999	18.2%
> $200,000	29.7%
Diver certification	
Open Water	9.6%
Advanced Open Water	43.2%
Technical	7.6%
Dive Master	17.5%
Dive Instructor	22.1%
Dive partner	
Partner/spouse	32%
Children	1.7%
Parent/siblings	2.0%
Friends	38.9%
Acquaintances	20.5%
Other	5.0%

respondents (5% of the total sample) identified an "other" category as the most frequent dive partner, however, because no further details are offered by respondents, this group of divers is assumed to bear similarities to acquaintance divers.

4.2. Descriptive statistics

Approximately half of respondents (51.5%) think it is likely they will encounter coral bleaching within the next 5 years at the dive place they specified (M = 2.78, SD = 1.30). In contrast, 74.5% of respondents think it is likely they will encounter coral bleaching in the next 5 years while diving elsewhere (M = 2.11, SD = 1.03). Most respondents (89.4%) would experience a decrease in dive satisfaction were coral bleaching to be encountered at the dive place they specified (M = 4.37, SD = 0.86), while a slightly lower proportion (83.1%) would experience a decrease in trip satisfaction (M = 4.15, SD = 0.89).

Overall, diving outside the region was considered to be the most effective adaptation response, with 73.6% of respondents identifying it as effective (M = 3.83, SD = 1.16). Diving elsewhere within the region and diving elsewhere within the destination (BIS1) represent the perceived second and third most effective options, with 65.3% and 56.1% of respondents rating the adaptation response as effective respectively (M = 3.47, SD = 1.19 and M = 3.19, SD = 1.27). Reducing dive frequency was the most effective non-spatial adaptation response, with 45.2% of respondents identifying is as effective (M = 3.11, SD = 1.28), while changing one's activity received the lowest effectiveness rating, with 61% of respondents perceiving it to be ineffective (M = 2.21, SD = 1.22).

As with response efficacy, overall, respondents were most confident (in order of decreasing confidence) in their ability to dive elsewhere outside the region (M = 4.30, SD = 0.88), dive elsewhere within the region (M = 3.99, SD = 1.01), and dive elsewhere within the destination (M = 3.76, SD = 1.23), with 87.5%, 80.9%, and 70.6% confidence respectively. Aside from spatial adaptation responses, respondents were most confident in their ability to reduce their dive frequency (M = 3.79, SD = 1.14), with 62.7% of respondents identifying as confident. Similar to response efficacy, change in activity evoked the least amount of confidence (48.5% not confident, M = 2.69, SD = 1.38).

Diving outside the region (M = 2.18, SD = 0.99) and diving elsewhere within the region (M = 2.67, SD = 1.03) represented the highest perceived costs (69% and 50.5% of respondents perceived the cost as high respectively), while perceived costs of the other adaptation responses were similar, with 20%–30% of respondents perceiving the costs as high.

Divers were most likely to indicate an intention to dive outside the region (85.8%, M = 4.29, SD = 0.96), reduce dive frequency (76.9%, M = 4.08, SD = 1.12), and dive elsewhere within the region (71%, M = 3.72, SD = 1.27), followed by an intention to dive elsewhere within the destination (43.9%, M = 2.90, SD = 1.47). A smaller proportion of respondents indicated a positive intention to change activity (21.8%, M = 2.32, SD = 1.30) or accept the situation (22.5%, M = 2.54, SD = 1.27).

4.3. Multiple regression analysis

A series of regression analyses were conducted to test the hypothesized relationships between perceived severity, perceived vulnerability, response efficacy, self-efficacy, and response cost and adaptation intentions. Separate regression analyses were run for each type of adaptation, such that the coping appraisal predictors were restricted to the corresponding adaptation response. For example, for activity adaptation intentions, the model included activity adaptation response efficacy, activity adaptation self-efficacy, and activity adaptation response cost.

Results from the regression analyses revealed that threat and coping appraisal variables were able to explain between 12.8% and 47.7% of the variance in adaptation intentions (Table 2), a statistically significant amount of the total variance in all of the models. PMT was able to explain the greatest amount of variance for cognitive ($R^2 = 0.477$, $F_{5, 297} = 59.36$, $p < .001$) and activity ($R^2 = 0.365$, $F_{5, 297} = 35.70$, $p < .001$) adaptation intentions, while explaining markedly less variation for intra-regional ($R^2 = 0.128$, $F_{5, 297} = 9.90$, $p < .001$) and inter-regional ($R^2 = 0.143$, $F_{5, 297} = 11.04$, $p < .001$) adaptation.

The six models varied in terms of what constructs contributed significantly to the explanation of adaptation intentions (Table 3). Overall, threat appraisal variables performed more poorly than coping appraisal variables. The first hypothesis predicted that greater perceived vulnerability would be associated with stronger adaptation intentions. However, perceived vulnerability was not a significant predictor of any adaptation intentions, and in fact emerged as a negative, though non-significant predictor of intra-destination ($\beta = -0.026$, $p = .608$) adaptation intentions. The second hypothesis predicted that a greater perceived threat would be associated with stronger adaptation intentions. This relationship held true for inter-regional ($\beta = 0.165$, $p = .003$) and temporal adaptation intentions ($\beta = 0.242$, $p < .001$), for which perceived severity was a significant positive predictor, but did not hold true for intra-destination ($\beta = -0.119$, $p = .021$) or cognitive ($\beta = -0.132$, $p = .004$) adaptation intentions, for which perceived severity was a significant negative predictor, suggesting this hypothesis was partially met. Perceived severity was not a significant predictor for intra-regional ($\beta = -0.002$, $p = .969$) or activity ($\beta = 0.014$, $p = .765$) adaptation intentions.

Hypotheses 3–5 are related to coping appraisal variables. The third

Table 2
Regression models for PMT variables predicting adaptation intentions.

	adj. R^2	$F_{(5, 297)}$
Intra-destination adaptation intentions (BIS1)	.247***	20.86
Intra-regional adaptation intentions (BIS2)	.128***	9.896
Inter-regional adaptation intentions (BIS3)	.143***	11.041
Temporal adaptation intentions (BIT)	.185***	14.735
Activity adaptation intentions (BIA)	.365***	35.697
Cognitive adaptation intentions (BIC)	.477***	59.360

*p < .05, **p < .01, ***p < .001.

Table 3
Regression coefficients for PMT variables predicting adaptation intentions.

		B	SE	β
Perceived vulnerability	BIS1	-.038	.074	-.026
	BIS2	.064	.068	.051
	BIS3	.080	.051	.084
	BIT	.061	.058	.055
	BIA	.055	.059	.043
	BIC	.041	.052	.033
Perceived severity	BIS1	-.196	.091	-.119*
	BIS2	-.003	.083	-.002
	BIS3	.227	.062	.192**
	BIT	.324	.070	.242***
	BIA	.022	.073	.014
	BIC	-.200	.067	-.132**
Response efficacy	BIS1	.159	.068	. 137*
	BIS2	.110	.062	.103
	BIS3	.113	.046	.138*
	BIT	.192	.049	.219***
	BIA	.301	.059	.283***
	BIC	.216	.051	.231***
Self-efficacy	BIS1	.466	0.69	.389***
	BIS2	.380	.073	.302***
	BIS3	.304	.061	.278***
	BIT	.217	.055	.220***
	BIA	.395	.051	.418***
	BIC	.471	.052	.484***
Response cost	BIS1	-.070	.066	-.055
	BIS2	-.187	.068	-.151**
	BIS3	-.116	.053	-.120*
	BIT	-.011	.049	-.012
	BIA	-.007	.051	-.006
	BIC	-.037	.048	-.032

*p < .05, **p < .01, ***p < .001.

hypothesis predicted that greater perceived effectiveness of an adaptation response at addressing the threat (i.e., avoiding dissatisfaction as a result of encountering coral bleaching) would be associated with stronger adaptation intentions. This hypothesis held true across the different adaptation responses, with response efficacy emerging as a significant positive predictor for all but intra-regional adaptation intentions, in which case the predictor was not significant ($\beta = 0.103$, $p = .077$). The fourth hypothesis predicted that greater perceived ability to carry out an adaptation response would be associated with stronger adaptation intentions. This hypothesis held true across the different adaptation responses, with self-efficacy emerging as a significant positive predictor for all adaptation intentions. Furthermore, self-efficacy consistently contributed the most to explained variance, emerging as the largest significant predictor for all but temporal adaptation intentions, where perceived severity was a marginally larger predictor ($\beta = 0.242$, $p < .001$ vs. $\beta = 0.220$, $p < .001$). Finally, the fifth hypothesis predicted that lower perceived response cost would be associated with stronger adaptation intentions. While this relationship held true across the different adaptation responses, response cost was only a significant negative predictor of intra-regional ($\beta = -.151$, $p = .007$) and inter-regional adaptation intentions ($\beta = -0.120$, $p = .030$), providing mixed support for hypothesis 5.

5. Discussion

5.1. How scuba divers will adapt

Change in location is the most common adaptation cited in climate change adaptation studies (Behringer et al., 2000; Dawson et al., 2013; König, 1998). However, few studies have considered different geographic scales of spatial substitution, instead specifying “outside the region” (e.g., König, 1998) or a different “more snow-reliable” alternative (e.g., Behringer et al., 2000). Considering both outside the region and within the region, Dawson et al. (2013) found that more skiers were likely to travel further afield (67% vs. 60%). This is consistent with findings from this study in which more divers indicated an intention to dive outside the region (86%) than elsewhere within the region (71%). Even fewer divers stated they would dive elsewhere within a destination (44%), lending credence to the notion that the likelihood of engaging in spatial substitution is influenced by geographic scale of the adaptation response.

In the case of coral bleaching, this may be due to the possible widespread nature of bleaching events. Examining the spatial variability in the decline of coral cover in the Indo-Pacific, Bruno and Selig (2007) found that coral cover did not significantly vary among ten subregions despite a number of differences within these regions thought to influence coral reef resilience, (e.g., enforcement, coral diversity). Another consideration is the extended nature of recovery. In some cases recovery rate can be detected within as little as 2 years, while in other locations recovery is absent even after 20 years (Baker et al., 2008). Rutty et al. (2015) found that skiers' engagement in spatial substitution varied depending on the duration of the impact, with respondents indicating a greater likelihood of change in location in the event of permanent closure (61%) over partial season closure (48%) or single day closure (30%). The relatively high proportion of divers intending to engage in spatial adaptation might suggest that they have taken into account the prolonged impact to a reef ecosystem.

After inter-regional spatial adaptation, the next most frequent response in this study was temporal adaptation, with 77% of respondents indicating they would reduce dive frequency if they were to encounter bleached reefs. This again aligns with findings from Dawson et al. (2013) (34%), König (1998) (31%), and Behringer et al. (2000) (32%). However, in a follow up to König's (1998) study, Pickering et al. (2010) found that the proportion of skiers' anticipating behavioral adaptation was 90% (up from 75% in 1996), of which a reduction in skiing was now the most common response (69% vs. 31%). The authors suggest this increase in sensitivity may reflect their experience of low snow conditions, noting the duration and depth of natural snow are declining in Australia, and the limited skiing opportunities available compared to other ski regions in which studies have taken place (e.g., Europe, North America). Similarly, considering the potential limiting of destination or regional dive alternatives described above may help to explain the much greater likelihood of reduction in frequency in this study compared to Dawson et al. (2013) (77% vs. 34%).

With respect to activity adaptation, 22% of respondents stated they would change activity if they were to encounter bleached reefs, indicating changing one's activity consistently proves to be the least attractive option provided as in previous studies (Behringer et al., 2000; Dawson et al., 2013; König, 1998; Pickering et al., 2010; Rutty et al., 2015). However, Dawson et al. (2013) found that almost half (46%) of skiers would engage in an alternative leisure activity in the event of consistently poor snow season in the future. This could suggest a potential difference in the necessity of resource condition for skiing compared to diving. Though studies investigating diver motivations consistently cite the opportunity to look at corals and other underwater marine life as the main reason for diving (e.g., Ditton et al., 2002; Garrod, 2008), these elements are not essential for scuba diving to occur – the only requirement is water of sufficient depth. In contrast, snow is required for skiing to take place. Thus, from a demand-perspective, scuba diving may be less vulnerable to alternative activity engagement. Note this does not take into consideration the implementation of supply-side adaptations (e.g., artificial snow, artificial reefs), which may not be equivalent in terms of contribution to activity experience.

Unlike previous studies into skiers' behavioral adaptation, this study included a measure of cognitive adaptation. Only 23% of respondents stated they would accept the situation if coral bleaching were encountered. This differs from previous studies into stress-coping response, which find that cognitive coping strategies often have a higher mean score than behavioral coping (e.g., Manning and Valliere, 2001;

Schuster et al., 2006; Yoon, 2012), indicating a stronger preference for cognitive adaptation. Notably, in these studies, respondents were asked to indicate the extent to which a list of coping responses described their response to the negative situations or conditions they experienced. In comparison, this study asked respondents to make their decision based on a hypothetical scenario. It is possible that this methodological difference contributes to this difference in findings.

5.2. Why scuba divers will/will not adapt

PMT explained a statistically significant amount of the total variance in all six of the adaptation models, indicating the regression models are statistically significantly better at predicting adaptation intentions than the intercept-only model. However, the total amount of variance explained and the extent to which predictors contributed significantly to the explanation of adaptation intentions varied considerably.

PMT explained between 12.8% and 47.7% of the variance in adaptation intentions. This is comparable to previous studies applying PMT to climate change adaptation intentions where between 23% and 49% of variance in adaptation intentions was explained (Dang et al., 2014; Koerth et al., 2013; Kuruppu and Liverman, 2011; Tapsuwan and Rongrongmuang, 2015; Truelove et al., 2015; van Duinen et al., 2015). The model explained the greatest amount of variance for activity (BIA) and cognitive (BIC) adaptation intentions. Interestingly, these were the two adaptation options divers were least like to employ. These adaptations were also perceived as being the least effective (i.e., response efficacy) and least confident in one's ability to carry out (i.e., self-efficacy). Thus, it appears that PMT is a stronger model when there is a perceived restriction of choice. That is to say, the decision about intention to adapt when the response is perceived to be ineffective and one is perceived to be unable to perform said adaptation may be simpler by virtue of these perceptions than when the response is perceived to be effective and one is perceived to be capable. This is consistent with findings that models with the least explained variance (BIS2 and BIS3) are associated with the highest perceived effectiveness and greatest perceived ability to perform.

Response efficacy and self-efficacy consistently emerged as the strongest significant predictors of adaptation intentions in the expected direction. This is consistent with previous studies applying PMT to climate change adaptation (e.g., Dang et al., 2014; Kuruppu and Liverman, 2011; Truelove et al., 2015) and meta-analyses of health studies (Floyd et al., 2004; Milne et al., 2000). These findings demonstrate the value of considering coping appraisal variables when evaluating what motivates people to engage in adaptation to ensure a satisfactory dive experience.

Response costs, though consistent in its relationship to adaptation intentions in the expected direction, was only a significant predictor of intra-regional and inter-regional adaptation intentions (BIS2 and BIS3). It is notable that these are the adaptation options that have the highest monetary cost. While efforts were made to distinguish different types of costs that could be collectively considered (e.g., personal, social), it is not clear whether this instruction was heeded.

Overall, threat appraisal variables performed more poorly, which is consistent with previous studies (e.g., Horng et al., 2014; Tapsuwan and Rongrongmuang, 2015; van Duinen et al., 2015). Perceived vulnerability was not a significant predictor of any adaptation intentions, and in fact emerged as a negative, though non-significant predictor of intra-destination adaptation intentions. It is possible this is because of the phrasing of behavioral intention questions. Framed as “if coral reefs that are mostly white were to persist in [dive location] for several years”, a phrasing adopted based on previous investigations into behavioral adaptation (e.g., “if poor ski/snowboard conditions occurred in 3 out of the next 5 winters”, Dawson, 2009), this precludes the perceived likelihood of actually encountering bleaching. Examination of the different scales of perceived vulnerability and adaptation intentions provides some support for this explanation. Respondents indicated a much greater perceived vulnerability to bleached coral reefs elsewhere than within a self-specified dive location (74.5% vs. 51.5%). Meanwhile, the effect size of perceived vulnerability is greatest for inter-regional adaptation and lowest for intra-destination intention. That is to say, perceived vulnerability is a stronger predictor when there is greater consistency with what one is expecting to encounter.

Perceived severity was a significant positive predictor for inter-regional and temporal adaptation intentions, but a significant negative predictor of intra-destination and cognitive adaptation intentions and non-significant predictor of intra-regional and activity adaptation intentions. This suggests that the nature of the relationship may vary depending on the type of coping strategy under consideration. In the case of cognitive adaptation, it may be harder to accept a situation if a threat is deemed to be more severe. This is consistent with findings from stress-coping studies. For example, Miller and McCool (2003) found that higher levels of stress were negatively associated with coping strategies characterized as cognitive adjustment. That is, as stress levels increased respondents were less likely to employ cognitive adjustment strategies. These cognitive adjustments were more likely to be associated with lower levels of stress, for the variables measured in this analysis.

Just as van Duinen et al. (2015) found that the scale of implementation matters with respect to the predictor's explanatory power, perceived severity may have emerged as a negative predictor for intra-destination adaptation because of the scale of the threat. As discussed previously, coral bleaching may extend to other areas within a destination, in which case a greater perceived threat could result in a decreased likelihood to adapt. Note, respondents indicated a decrease in perceived effectiveness from macro (i.e., RES3) to micro-scale (i.e., RES1) adaptation. Similarly, it is possible that the predictor was non-significant for intra-regional adaptation (BIS2) because of the lack of clarity around the phrasing “in a region” and ambiguity around the extent to which coral bleaching might affect the surrounding region.

6. Conclusion

The study contributes to the climate change and tourism literature, which has largely neglected to consider the value of theoretical constructs within behavioral psychology. This is one of the first studies to apply Protection Motivation Theory to consider the cognitive appraisal process of tourists’ adaptation behaviour, building on and addressing the limitations of the study by Wang et al. (2018), and, advancing the limited understanding of the impact that climate change is likely to exact on diver demand.

This study partially supported the Protection Motivation Theory proposed by Rogers (1983). Consideration of multiple adaptation responses demonstrates the variability of model performance and highlights the need to consider the context of adaptation behavior when interpreting results. For example, the hypothesis that perceived severity is a positive predictor of adaptation intentions may not be true for cognitive adaptation. It is recommended that future studies investigating tourists' adaptive responses to climate change apply PMT to different recreation and threat contexts and consider different adaptation strategies to gauge the general applicability of the framework.

Addressing some of the methodological limitations identified may also increase the utility of the framework. In particular, investigating respondents' actual encounters with coral bleaching may help to address the low performance of threat appraisal variables. Korstanje (2009) argued that the study of risk perception prior to one's actual holiday is more accurately an assessment of anxiety given that fear and risk perception require a direct stimulus. While a person can either confront the hazard at hand or escape the situation at the point risk perception, anxiety is a secondary emotion experienced before concreteness develops, often emerging from news or rumors. He suggests that this emphasis on pre-trip assessment is a main limitation of tourism

applications of risk perception theory.

In interpreting the relatively weak performance of threat appraisal as predictors of tourists' carbon reduction behaviors, Horng et al. (2014) consider the underlying motivation that prompts protective behaviors, suggesting that, while health protection is motivated by fear, environmental protection behaviors appear to be motivated by responsibility. In this study, tourist adaptation is framed as being motivated by gratification, specifically a desire to have a satisfactory dive experience. However, some studies have criticized the underlying premise that satisfaction will lead to positive behavioral intentions, suggesting that simply satisfying consumers may not be sufficient to drive repurchase behavior (Agustin and Singh, 2005; Seiders et al., 2005; Voss et al., 2010). Applying this principle to adaptation intentions, is it enough to consider satisfaction as the primary driver of cognitive or behavioral change? Future studies could investigate different motivations for adaptation, as these may differ from past investigations into motivations for participation.

This study provided the first empirical evidence of scuba diver adaptation in response to marginal reef conditions, indicating that the majority of respondents would significantly alter their behavior in some way. As coral bleaching and mortality are expected to continue to increase in frequency and magnitude, the economic ramifications could be significant. The results of the study highlighted the importance of considering different scales of spatial adaptation in the context of range of a bleaching event. Ultimately, there is likely to be a shift in divers away from a dive region that is experiencing bleaching. However, dive operators may be able to moderate this shift by influencing scuba divers' perception of available alternatives. It is recommended that further research investigate the acceptability of alternative dive sites, including the use of artificial reefs. A limitation of this study is that it did not take into consideration adaptations in supply-side factors. Yet, such modifications will likely become more common in response to enduring effects. In the context of scuba diving, Kirkbride-Smith et al. (2013) found that novice divers elected artificial reefs in preference to natural reefs, suggesting there are supply-side adaptations that can be utilized to retain a portion of the dive market.

Another limitation of the current investigation is that measures of intention were assessed at a single point in time, and thus does not account for the fact that one's intention to perform an action can vary from one point in time to the next. Further to this point, the study did not assess the extent to which intention translated into action. In this regard, additional follow-up research with respondents who have since encountered coral bleaching may offer insights into the models' ability to predict actual behaviors.

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